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COMMUNICATION FROM THE COMMISSION

in the framework of the implementation of Commission Regulation (EU) No …/… implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters, and of the implementation of Commission Delegated Regulation (EU) No …/… supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to the energy labelling of space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control, solar device and passive flue heat recovery device

(2012/C …/…)

(Text with EEA relevance)

1. Publication of titles and references of transitional methods of measurement and calculation[1] for the implementation of Regulation (EU) No …/…, and in particular Annexes III and VI thereof, and for the implementation of Regulation (EU) No …/…, and in particular Annexes VII and X thereof.

2. Parameters *in italics* are determined in Regulation (EU) No …/… and in Regulation (EU) No …/…

3. References

Parameter	**Organisation**	**Reference/Title**	**Notes**
Boiler space heaters and boiler combination heaters using gaseous fuel			
η, P, design types, P_{stby}, P_{ign}	CEN	FprEN 15502-1: July 2010. Gas-fired heating boilers - Part 1: General requirements and tests;	FprEN 15502-1 is set to replace EN 297, EN 483, EN 677, EN 656, EN 13836, EN 15420.
Useful heat output at rated heat output P_4 and useful efficiency at rated heat output η_4 at 80/60 °C	CEN	§ 3.1.6 Nominal output (definition, symbol P_n); § 3.1.5.7 Useful efficiency (definition, symbol η_u); § 9.2.2 (test);	All efficiency values are expressed in *GCV*.
Design types, definitions	CEN	§ 3.1.10. Design types of boilers with definitions of "combination-boiler"; "low temperature boiler" and "condensing boiler". § 8.15. Formation of condensate (requirements and test);	
Useful heat output at 30 % of rated heat output P_1 and useful efficiency at 30 % of rated heat output η_1 at partial heat input and low temperature regime	CEN	§ 3.1.5.7. Useful efficiency (definition, symbol η_u); § 9.3.2. Useful efficiency at part load, Tests;	Note that according to the standards: 1) tests are carried out at 30 % of nominal heat input, not at minimum steady state heat input; 2) test return temperatures are 30 °C (condensing boiler), 37 °C (low temperature boiler) or 50 °C (standard boiler).
Standby heat loss P_{stby}	CEN	§ 9.3.2.3.1.3 Standby losses (test);	
Ignition burner power consumption P_{ign}	CEN	§ 8.4.3. *Ignition rate.*	Applies to ignition burners operating at main burner-off mode.
Emission of nitrogen oxides NO_x	CEN	FprEN 15502-1: July 2010. § 8.13. NO_x	NO_x emission values are expressed in gross

[1] It is intended that these transitional methods will ultimately be replaced by harmonised standard(s). When available, reference(s) to the harmonised standard(s) will be published in the Official Journal of the European Union in accordance with Articles 9 and 10 of Directive 2009/125/EC.

Parameter	Organisation	Reference/Title	Notes
		(classification, test- and calculation methods)	calorific value *GCV*.
Boiler space heaters and boiler combination heaters using liquid fuel			
General test conditions		EN 304:1992; A1:1998; A2:2003; Heating boilers - Test code for heating boilers for atomizing oil burners; Section 5 ('Tests').	
Standby heat loss P_{stby}	CEN	EN 304 as above; § 5.7 Determination of standby loss.	P_{stby} corresponds to parameter 'q' in EN 304.
Seasonal space heating energy efficiency in active mode η_{son} with test results for useful output P	CEN	For condensing boilers: EN 15034:2008. Heating boilers - Condensing heating boilers for fuel oil; § 5.6 Useful efficiency. For standard and low temperature boilers: EN 304:1992; A1:1998; A2:2003; Heating boilers - Test code for heating boilers for atomizing oil burners; Section 5 ('Tests').	EN 15034 refers to condensing oil boilers. For boilers with forced draught burner similar sections apply in EN 303-1, EN 303-2 and EN 303-4. For atmospheric, not fan-assisted burners EN 1:1998 applies. Test conditions (power and temperature settings) for η_1 and η_4 are the same as for gas-fired boilers described above.
Emission of nitrogen oxides NO_x	CEN	EN 267:2009 Automatic forced draught burners for liquid fuels; § 4.8.5. Emission limit values for NOx and CO; § 5. Testing. ANNEX B. Emission measurements and corrections.	NO_x emission values are expressed in *GCV*.
Cogeneration space heaters			
Useful heat output at rated heat output of cogeneration space heater with supplementary heater disabled $P_{CHP100+Sup0,}$ useful heat output at rated heat output of cogeneration space heater with supplementary heater enabled $P_{CHP100+Sup100,}$ Useful efficiency at rated heat output of cogeneration space heater with supplementary heater disabled	CEN	prEN 50465: 2010 Draft ed; 2. Gas appliances – Combined Heat and Power appliance of nominal heat input inferior or equal to 70 kW.	

Parameter	Organisation	Reference/Title	Notes
$\eta_{CHP100+Sup0,}$ Useful efficiency at rated heat output of cogeneration space heater with supplementary heater enabled $\eta_{CHP100+Sup100,}$ Electrical efficiency at rated heat output of cogeneration space heater with supplementary heater disabled $\eta_{el,CHP100+Sup0}$, Electrical efficiency at rated heat output of cogeneration space heater with supplementary heater enabled $\eta_{el,CHP100+Sup100}$			
P_{stby}, P_{ign}	CEN	FprEN 15502-1: July 2010, Gas-fired heating boilers - Part 1: General requirements and tests;	
Standby heat loss P_{stby}	CEN	§ 9.3.2.3.1.3 Standby losses (test);	
Ignition burner power consumption P_{ign}	CEN	§ 9.3.2 Q_3 = permanent ignition burner.	Applies to ignition burners operating at main burner-off mode.
Emission of nitrogen oxides NO_x	CEN	FprEN 15502-1: July 2010; § 8.13. NO_x (classification, test- and calculation methods).	NO_x emission values are expressed in *GCV*
Boiler space heaters, boiler combination heaters and cogeneration space heaters			
Auxiliary electricity consumption at full load *elmax,* at part load *elmin* and in standby mode P_{SB}	CEN	EN 15456:2008: Heating boilers - Electrical power consumption for heat. FprEN 15502 for gas boilers.	Measurement without circulator (pump).
Sound power level L_{WA}	CEN	For sound power level, indoor measured: EN 15036 - 1: Heating boilers - Test regulations for airborne noise emissions from heat generators - Part 1: Airborne noise emissions from heat generators.	For the acoustics, EN 15036 - 1 is referring to ISO 3743-1 Acoustics - Determination of sound power levels of noise sources - Engineering methods for small, movable sources in reverberant fields - Part 1: Comparison method for hard-walled test rooms, as well as to other allowable methods, each with their own accuracies.
Seasonal space heating	European Commission	Point 4 of this	Additional elements for

Parameter	Organisation	Reference/Title	Notes
energy efficiency η_s of boiler space heaters, boiler combination heaters and cogeneration space heaters		Communication.	measurements and calculations related to the seasonal space heating energy efficiency of boiler space heaters, boiler combination heaters and cogeneration space heaters.
Heat pump space heaters and heat pump combination heaters			
Testing methods, vapour compression electrically driven heat pumps	CEN	FprEN 14825: October 2011 Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling – Testing and rating at part load conditions and calculation of seasonal performance; Section 8: Test methods for testing capacities, EER and COP values during active mode at part load conditions Section 9: Test methods for electric power consumption during thermostat off mode, standby mode and crankcase heater mode	
Testing methods, vapor compression liquid or gaseous fuel driven heat pumps	CEN	FprEN 14825: October 2011 Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling – Testing and rating at part load conditions and calculation of seasonal performance; Section 8: Test methods for testing capacities, EER and COP values during active mode at part load conditions; Section 9: Test methods for electric power consumption during thermostat off mode, standby mode and	Until publication of a new European Standard.

Parameter	Organisation	Reference/Title	Notes
		crankcase heater mode.	
Testing methods, liquid or gaseous fuel sorption heat pumps	CEN	prEN 12309 – 2 Gas-fired absorption and adsorption air-conditioning and/or heat pump appliances with a net heat input not exceeding 70 kW – Part 2: Rational use of energy; Section 6.1 Methods of test, General; Section 6.3 Heating mode tests (excluding Table 12. Rating test conditions for all appliances in the heating mode)	A working document dealing with testing methods at full load and part load is in progress within the CEN/TC299 WG2 experts group.
Vapor compression electrically and liquid or gaseous fuel engine driven heat pumps, Liquid or gaseous fuel sorption heat pumps Test points for air-to-water, brine-to-water and water-to-water units for medium temperature application for average, warmer and colder climate conditions for calculation of seasonal coefficient of performance *SCOP* for electrically driven heat pumps and seasonal primary energy ratio *SPER* for liquid or gaseous fuel engine driven heat pumps and liquid or gaseous fuel sorption heat pumps	CEN	FprEN 14825: October 2011; Section 5.4.4, Tables 18, 19 and 20 (air-to-water); Section 5.5.4, Tables 30, 31 and 32 (brine-to-water, water-to-water); Where the outlet temperatures set out in column "variable outlet" are to be applied for heat pumps that control the outlet (flow) water temperature according to the heat demand. For heat pumps that do not control the outlet (flow) water temperature according to the heat demand but have a fixed outlet temperature, outlet temperature should be set according to the "fixed outlet".	For heat pumps other than vapour compression electrically driven heat pumps FprEN 14825 applies until publication of a new European Standard. Medium temperature corresponds to high temperature in FprEN 14825. Tests are done according to FprEN 14825, section 8: For fixed capacity units, tests are applied as indicated in FprEN 14825, section 8.4. Either the outlet temperatures during the tests are the ones to obtain the average outlet temperatures corresponding to the declaration points in FprEN 14825 OR this data should be obtained by linear interpolation / extrapolation from the test points in EN 14511-2, complemented with test at other outlet temperatures when necessary. For variable capacity units, FprEN 14825 section 8.5.2 are applied. Either the conditions during the tests are the same as for the

Parameter	Organisation	Reference/Title	Notes
			declaration points specified in that standard OR tests can be performed at other outlet temperatures and part load conditions and the results linearly interpolated, extrapolated, to determine the data for the declaration points in FprEN 14825. Apart from test points A to F, "in case the TOL is below – 20 °C, an additional calculation point has to be taken from the capacity and COP at – 15 °C conditions" (cit. prEN 14825 § 7.3). For the purpose of this communication, this point will be called "G".
Vapor compression electrically and liquid or gaseous fuel engine driven heat pumps, Liquid or gaseous fuel sorption heat pumps Test points for air-to-water units, brine-to-water and water-to-water under low temperature application for average, warmer and colder climate conditions for calculation of seasonal coefficient of performance *SCOP* for electrically driven heat pumps and seasonal primary energy ratio *SPER* for liquid or gaseous fuel engine driven heat pumps and liquid or gaseous fuel sorption heat pumps	CEN	FprEN 14825: October 2011; Section 5.4.2, Tables 11, 12 and 13 (air-to-water); Section 5.5.2, Tables 24, 25 and 26 (brine-to-water, water-to-water); Where the outlet temperatures set out in column "variable outlet" are to be applied for heat pumps that control the outlet (flow) water temperature according to the heat demand. For heat pumps that do not control the outlet (flow) water temperature according to the heat demand but have a fixed outlet temperature, outlet temperature should be set according to the "fixed outlet".	Same notes as for average climate and medium temperature application.
Vapor compression electrically driven heat pump Calculation of seasonal coefficient of performance SCOP	CEN	FprEN 14825: October 2011 Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling – Testing and rating at part	

Parameter	Organisation	Reference/Title	Notes
		load conditions and calculation of seasonal performance; Section 7: Calculation methods for reference SCOP, reference $SCOP_{on}$ and reference $SCOP_{net}$.	
Vapor compression liquid or gaseous fuel engine driven heat pump, Liquid or gaseous fuel sorption heat pump Calculation of seasonal primary energy ratio *SPER*	CEN	New European Standards under development	The SPER formulae for liquid or gaseous fuel heat pump will be established in analogy to the SCOP formulae for vapor compression electrically driven heat pumps: COP, $SCOP_{net}$, $SCOP_{on}$ and $SCOP$ will be replaced by GUE_{GCV}, PER, $SPER_{net}$, $SPER_{on}$ and $SPER$. For liquid or gaseous fuel sorption heat pump, a working document including a SPER calculation method is in progress within the CEN/TC299 WG2 experts group.
Seasonal space heating energy efficiency η_s of heat pump space heaters and heat pump combination heaters	European Commission	Point 5 of this Communication	Additional elements for calculations related to the seasonal space heating energy efficiency of heat pump space heaters and heat pump combination heaters.
Temperature controls			
Definition of temperature controls classes, contribution of temperature controls to seasonal space heating energy efficiency η_s of packages of space heater, temperature control and solar-only system or of packages of combination heater, temperature control, solar-only system and passive flue heat recovery device	European Commission	Point 6 of this Communication	Additional elements for calculations related to the contribution of temperature controls to the seasonal space heating energy efficiency of packages of space heater, temperature control and solar-only system or of packages of combination heater, temperature control, solar-only system and passive flue heat recovery device.
Passive flue heat recovery devices			
Testing method, annual heat recovery contribution combitrans, contribution of passive	European Commission	Point 7 of this Communication	Additional elements for measurement and calculations related to the contribution of passive

Parameter	Organisation	Reference/Title	Notes
flue heat recovery devices to the seasonal space heating energy efficiency η_s of packages of combination heater, temperature control, solar-only system and passive flue heat recovery device			flue heat recovery devices to the seasonal space heating energy efficiency of packages of combination heater, temperature control, solar-only system and passive flue heat recovery device.

4. Additional elements for measurements and calculations related to the seasonal space heating energy efficiency of boiler space heaters, boiler combination heaters and cogeneration space heaters

4.1. Test points

(a) boiler space heaters and boiler combination heaters: the useful efficiency values η_4, η_1 and the useful heat output values P_4, P_1 are measured;

(b) cogeneration space heaters:

– cogeneration space heaters not equipped with supplementary heaters: the useful efficiency value $\eta_{CHP100+Sup0}$, the useful heat output value $P_{CHP100+Sup0}$ and the electrical efficiency value $\eta_{el,CHP100+Sup0}$ is measured;

– cogeneration space heaters equipped with supplementary heaters: the useful efficiency values $\eta_{CHP100+Sup0}$, $\eta_{CHP100+Sup100}$, the useful heat output values $P_{CHP100+Sup0}$, $P_{CHP100+Sup100}$ and the electrical efficiency values $\eta_{el,CHP100+Sup0}$, $\eta_{el,CHP100+Sup100}$ are measured.

4.2. Calculation of the seasonal space heating energy efficiency

The seasonal space heating energy efficiency η_s is defined as

$\eta_s = \eta_{son} - \sum F(i)$

Where:

(a) η_{son} is the seasonal space heating energy efficiency in active mode, calculated according to point 4.3 and expressed in %;

(b) F(i) are corrections calculated according to point 4.4 and expressed in %.

4.3. Calculation of the seasonal space heating energy efficiency in active mode

The seasonal space heating energy efficiency in active mode η_{son} is calculated as follows:

(a) for fuel boiler space heaters and fuel boiler combination heaters:

$\eta_{son} = 0{,}85 \bullet \eta_1 + 0{,}15 \bullet \eta_4$

(b) for electric boiler space heaters and electric boiler combination heaters:

$\eta_{son} = \eta_4$

Where:

$\eta_4 = P_4 / (\text{EC} \bullet CC)$, with

EC = electricity consumption to produce useful heat output P_4

(c) for cogeneration space heaters not equipped with supplementary heaters:

$\eta_{son} = \eta_{CHP100+Sup0}$

(d) for cogeneration space heaters equipped with supplementary heaters:

$\eta_{son} = 0{,}85 \bullet \eta_{CHP100+Sup0} + 0{,}15 \bullet \eta_{CHP100+Sup100}$

4.4. Calculation of F(i)

(a) The correction F(1) accounts for a negative contribution to the seasonal space heating energy efficiency of heaters due to adjusted contributions of temperature controls to seasonal space heating energy efficiency of packages of space heater, temperature control and solar-only system or of packages of combination heater, temperature control, solar-only system and passive flue heat recovery device, as set out in point 6.2. For boiler space heaters, boiler combination heaters and cogeneration space heaters, the correction is F(1) = 3 %.

(b) The correction F(2) accounts for a negative contribution to the seasonal space heating energy efficiency by auxiliary electricity consumption, expressed in %, and is given as follows:

– for fuel boiler space heaters and fuel boiler combination heaters:

$F(2) = 2{,}5 \bullet (0{,}15 \bullet elmax + 0{,}85 \bullet elmin + 1{,}3 \bullet P_{SB}) / (0{,}15 \bullet P_4 + 0{,}85 \bullet P_1)$

– for electric boiler space heaters and electric boiler combination heaters:

$F(2) = 1{,}3 \bullet P_{SB} / ((0{,}15 \bullet P_4 + 0{,}85 \bullet P_1) \bullet CC)$

– for cogeneration space heaters not equipped with supplementary heaters:

$F(2) = 2{,}5 \bullet (elmax + 1{,}3 \bullet P_{SB}) / P_{CHP100+Sup0}$

– for cogeneration space heaters equipped with supplementary heaters:

$F(2) = 2{,}5 \bullet (0{,}15 \bullet elmax + 0{,}85 \bullet elmin + 1{,}3 \bullet P_{SB}) / (0{,}15 \bullet \eta_{CHP100+Sup100} + 0{,}85 \bullet \eta_{CHP100+Sup0})$

OR a default value as set out in EN 15316-4-1 may be applied.

[NB: The previous formulae F(2) = 2,5 • (0,15 • elmax + 0,85 • elmin + 3,3 • P_{SB}) / P_4 underestimated the impact of auxiliary electricity consumption: The total heating output is 1 000 hours • P_4. But the electricity consumption is not only for 1 000 hours but for 1 000 / (0,85 • 0,3 + 0,15 • 1) or about 2 469 hours. The 3,3 coefficient of the standby electricity consumption suggests the intent to use the heater for 3 300 hours. In that case the coefficient 3,3 should be replaced with 3,3 / 2,47 as corrected in the formulae.]

(c) The correction F(3) accounts for a negative contribution to the seasonal space heating energy efficiency by standby heat loss and is given as follows:

– for fuel boiler space heaters and fuel boiler combination heaters:

$F(3) = 0,5 \bullet P_{stby} / P_4$

– for electric boiler space heaters and electric boiler combination heaters:

$F(3) = 0,5 \bullet P_{stby} / (P_4 \bullet CC)$

– for cogeneration space heaters not equipped with supplementary heaters:

$F(3) = 0,5 \bullet P_{stby} / P_{CHP100+Sup0}$

– for cogeneration space heaters equipped with supplementary heaters:

$F(3) = 0,5 \bullet P_{stby} / P_{CHP100+Sup100}$

OR a default value as set out in EN 15316-4-1 may be applied.

(d) The correction F(4) accounts for a negative contribution to the seasonal space heating energy efficiency by ignition burner power consumption and is given as follows:

– for fuel boiler space heaters and fuel boiler combination heaters:

$F(4) = 0,5 \bullet P_{ign} / P_4$

– for cogeneration space heaters not equipped with supplementary heaters:

$F(4) = 0,5 \bullet P_{ign} / P_{CHP100+Sup0}$

– for cogeneration space heaters equipped with supplementary heaters:

$F(4) = 0,5 \bullet P_{ign} / P_{CHP100+Sup100}$

(e) For cogeneration space heaters, the correction F(5) accounts for a positive contribution to the seasonal space heating energy efficiency by the electrical efficiency and is given as follows:

– for cogeneration space heaters not equipped with supplementary heaters:

$F(5) = - 2,5 \bullet \eta_{el,CHP100+Sup0}$

– for cogeneration space heaters equipped with supplementary heaters:

$$F(5) = - 2{,}5 \bullet (0{,}85 \bullet \eta_{el,CHP100+Sup0} + 0{,}15 \bullet \eta_{el,CHP100+Sup100})$$

5. Additional elements for calculations related to the seasonal space heating energy efficiency of heat pump space heaters and heat pump combination heaters

5.1. Calculation of the seasonal space heating energy efficiency

The seasonal space heating energy efficiency η_s is defined as

(a) for heat pump space heaters and heat pump combination heaters using electricity:

$$\eta_s = (1/CC) \bullet SCOP - \Sigma F(i)$$

(b) heat pump space heaters and heat pump combination heaters using fuels:

$$\eta_s = SPER - \Sigma F(i)$$

F(i) are corrections calculated according to point 5.2 and expressed in %.

5.2. Calculation of F(i)

(a) The correction F(1) accounts for a negative contribution to the seasonal space heating energy efficiency of heaters due to adjusted contributions of temperature controls to seasonal space heating energy efficiency of packages of space heater, temperature control and solar-only system or of packages of combination heater, temperature control, solar-only system and passive flue heat recovery device, as set out in point 6.2. For heat pump space heaters and heat pump combination heaters, the correction is F(1) = 3 %.

(b) The correction F(2) accounts for a negative contribution to the seasonal space heating energy efficiency by electricity consumption of ground water pump(s) expressed in %. For water-/brine-to-water heat pump space heaters and heat pump combination heaters, the correction is F(2) = 5 %.

6. Additional elements for calculations related to the contribution of temperature controls to the seasonal space heating energy efficiency of packages of space heater, temperature control and solar-only system or of packages of combination heater, temperature control, solar-only system and passive flue heat recovery device

6.1. Definition of temperature controls classes

Class I - On/off Room Thermostat: A room thermostat that controls the on/off operation of a heater. Performance parameters, including switching differential and room temperature control accuracy are determined by the thermostat's mechanical construction.

Class II - Weather compensator control, for use with modulating heaters: A heater flow temperature control that varies the set point of the flow temperature of water leaving the heater dependant upon prevailing outside temperature and selected

weather compensation curve. Control is achieved by modulating the output of the heater.

Class III - Weather compensator control, for use with on/off output heaters: A heater flow temperature control that varies the set point of the flow temperature of water leaving the heater dependant upon prevailing outside temperature and selected weather compensation curve. Heater flow temperature is varied by controlling the on/off operation of the heater.

Class IV - TPI room thermostat, for use with on/off output heaters: An electronic room thermostat that controls both thermostat cycle rate and in-cycle on/off ratio of the heater proportional to room temperature. TPI control strategy reduces mean water temperature, improves room temperature control accuracy and enhances system efficiency.

Class V - Modulating room thermostat, for use with modulating heaters: An electronic room thermostat that varies the flow temperature of the water leaving the heater dependant upon measured room temperature deviation from room thermostat set point. Control is achieved by modulating the output of the heater.

Class VI - Weather compensator and room sensor, for use with modulating heaters: A heater flow temperature control that varies the flow temperature of water leaving the heater dependant upon prevailing outside temperature and selected weather compensation curve. A room temperature sensor monitors room temperature and adjusts the compensation curve parallel displacement to improve room comfort. Control is achieved by modulating the output of the heater.

Class VII - Weather compensator and room sensor, for use with on/off output heaters: A heater flow temperature control that varies the flow temperature of water leaving the heater dependant upon prevailing outside temperature and selected weather compensation curve. A room temperature sensor monitors room temperature and adjusts the compensation curve parallel displacement to improve room comfort. Heater flow temperature is varied by controlling the on/off operation of the heater.

Class VIII – Multi-sensor room temperature control, for use with modulating heaters: An electronic control, equipped with 3 or more room sensors that varies the flow temperature of the water leaving the heater dependant upon the aggregated measured room temperature deviation from room sensor set points. Control is achieved by modulating the output of the heater.

6.2. Contribution of temperature controls to seasonal space heating energy efficiency of packages of space heater, temperature control and solar-only system or of packages of combination heater, temperature control, solar-only system and passive flue heat recovery device

Class No.	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**
Value in %	1	2	1,5	2	3	4	3,5	5

7. Additional elements for measurement and calculations related to the contribution of passive flue heat recovery devices to the seasonal space heating energy efficiency of packages of combination heater, temperature control, solar-only system and passive flue heat recovery device

7.1. Testing

(a) Ensure that combination heater and passive flue heat recovery devices (PFHRD) are at ambient temperature Ta;

(b) Flush PFHRD with cold water Tcold of 10 °C until ingoing water temperature equals outgoing water temperature and immediately run combination heater in space heating mode at 50 % part load for 20 minutes at the temperature regime 55/45 °C;

(c) Stop the combination heater for 20 minutes (burner-off) to account for standing losses;

(d) Draw-off water from the PFHRD at 3 l/min, until water temperature is again 10 °C. During draw-off record water temperature and flow with an interval of 2 seconds or below.

7.2. Calculations

(a) Calculate the thermal energy content of the first 3,5 litres water drawn off (that is: average of small water draw-offs), Qtappedsmall;

(b) Calculate the thermal energy content of the complete draw-off (until Tout = 10°C), Qtappedlarge;

(c) Calculate the 24h average heat store power capacity Pstore in kW for the maximum load profile of the combination heater as follows:

Pstore = x • Qtappedsmall + y • Qtappedlarge) / 24

Where

– x = number of small draw-offs of declared maximum load profile;

– y = number of large draw-offs of declared maximum load profile;

(d) Calculate the average hourly hot water energy demand Ptap in kW of the declared maximum load profile between first and last daily draw-off (15 h): Ptap = Q_{ref}/15;

(e) From the annual flue gas losses in space heating mode Qflue in kWh/a, calculate the average loss over the heating season as:

Pflue = Qflue/allhrs [kW]; with

allhrs = 5 124 hours;

(f) The annual heat recovery contribution of the PFHRD combitrans in kWh/a is given as:

combitrans = allhrs • MIN(Pstore; Ptap; Pflue)

(g) The contribution of PFHRD to the water heating energy efficiency of packages of combination heater, temperature control, solar-only system and passive flue heat recovery devices, expressed in %, is calculated as follows:

PFHRD = 0.6 • 366 • Q_{ref} • [1 / (*CC* • *AEC* + *AFC* – combitrans) – 1 / (*CC* • *AEC* + *AFC*)]